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(56) Documents Cited:  
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& WPI Abstract Accession No.99-470752/40  
EP0351493 A2 & WPI Abstract Accession  
No.90-023952/04  
DE3905016 & WPI Abstract Accession  
No.90-261741/35  
JP110347820 & WPI Abstract Accession  
No.00-110458/10

(58) Field of Search:  
UK CL (Edition V) B3C C1B6B C1B6G C1B6J C1B6N  
INT CL<sup>7</sup> B23B 51/00 51/04  
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(54) Abstract Title: Stepped drill bit with spiral fluting

(57) A hole-cutting tool 1 or trepanner comprises an elongate tube having at one end teeth 15 adapted for cutting metal, and fluting 17 extending from between the teeth spirally along the tube, in which the external diameter of the tool is stepped 14, 18, 22 so as to enable the tool to cut more than one diameter of hole. The fluting is continuous through the steps as far as possible and the floor of the fluting is at an approximately constant radius. At the business end (cutting tip end) there is a gash 16 between each pair of teeth.

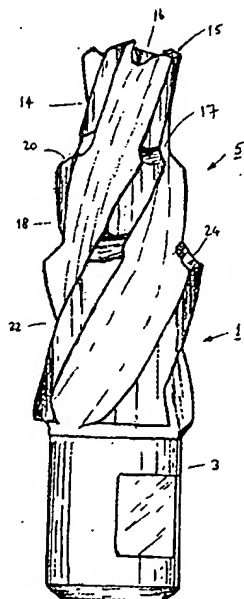


FIG. 1

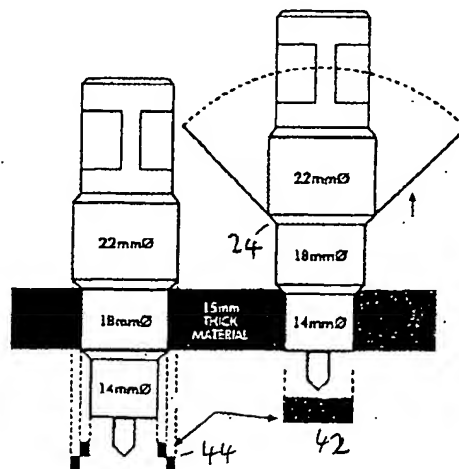


FIG. 2A FIG. 2B

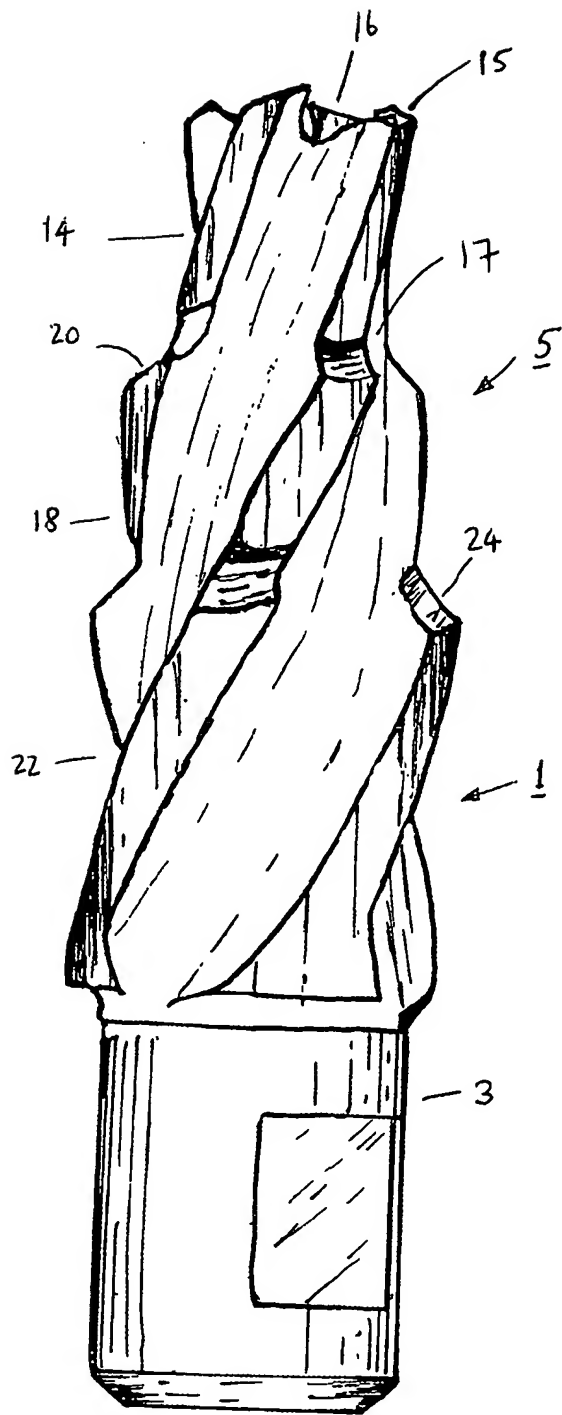


FIG. 1

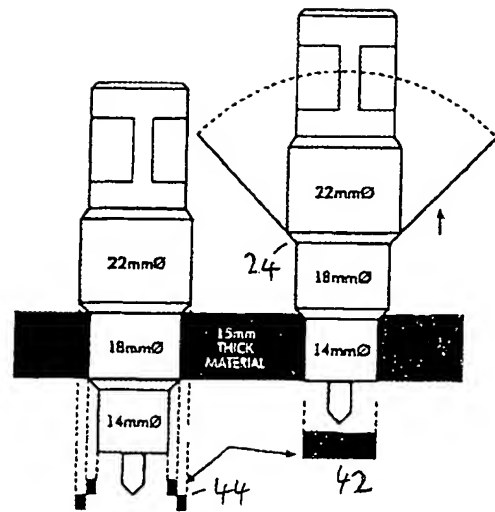


FIG. 2A

FIG. 2B

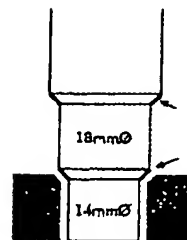


FIG. 3

## HOLE-CUTTING TOOL

The invention relates to a hole-cutting tool or trepanner principally, though not exclusively, for cutting holes in mild steel. Tools of this kind are disclosed in the  
5 Applicant's earlier patent applications GB 2278793 and 2319739. They are used on building sites and are useful for cutting holes in the webs of I-beams for attaching other beams or components.

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Clearly it is desirable to reduce the number of tools carried by a workman in a hazardous environment. The invention is conceived with this in mind.

15 According to the invention there is provided a hole-cutting tool comprising an elongate tube having at one end teeth adapted for cutting metal, and fluting extending from between the teeth spirally along the tube, in which the external diameter of the tool is stepped so as to enable  
20 the tool to cut more than one diameter of hole.

Surprisingly the presence of the step or steps does not adversely affect the working of the tool. There may be three diameters (two steps), for instance, the increase  
25 from one step to the next, in the direction away from the business end, being of the order of 20%. For instance a useful set of steps is 14mm, 18mm and 22mm external diameter. Each step may have the same axial length, for instance 15mm. The shoulders of the steps are preferably  
30 angled at about 45° to the axis. The fluting should be continuous through the steps as far as possible.

The arrangement of the teeth and fluting is preferably as shown in the Applicant's earlier application GB 2278793.  
35 Stepped drill bits are known; see for instance US 4582458 in the name of American Saw & Mfg. Company. However, it is not evident that this arrangement can be applied to

trepanning tools, in particular such tools with the chip-breaking tooth and flute arrangement of GB 2278793, in which the axial rake angle, formed by the intersection of the trailing wall of each gash with the corresponding flute floor surface, is substantially nearer the axial direction of the shaft than the fluting, and the angle of the floor of each gash to the radial plane of the shaft is between 20° and 35°, preferably between 24° and 34°.

For a better understanding of the invention embodiments will now be described with reference to the attached drawings, in which:

Fig. 1 shows a detailed drawing of a hole-cutting tool in accordance with the invention;

Fig. 2a shows the tool being used to cut an 18mm hole, and Fig. 2b shows it cutting a 14mm hole; and

Fig. 3 shows the countersunk steps.

In Fig. 1 a hole-cutting tool 1 comprises a shaft 3 to be inserted into and held in a power tool, and a main drill portion or business end 5. The drill portion has teeth 15 at its axial front end with spiral, i.e. generally helical, fluting 17 extending from between the teeth, forming spiral ridges which do the drilling. In this embodiment there are four teeth and four flutes, but there could be more or fewer. At the business end there is a gash 16 between each pair of teeth.

The drill portion has three sections of constant diameter stepped to increase away from the business end. The section 14 at the front end has a diameter of 14mm, the second section 18 has a diameter of 18mm and the third section 22 has a diameter of 22mm. Each of these sections is 15mm in axial length. Between each pair of sections

there are corresponding inclined steps or countersinks 20 and 24, whose shoulders are angled at about  $45^\circ$  to the axis, as seen in an axial plane. They are ground so as to rise slightly in the circumferential direction, following the fluting. They also slightly undercut the ridge just forward of them. The floor of the fluting on the other hand is more or less cylindrical so that the depth of the flute increases away from the tip, though the floor rises at the extreme shaft end. The bore of the tool is not quite constant along its length but is slightly tapered (narrowing), by perhaps  $\frac{1}{4}$ mm towards the business end from the shaft, so that the plug does not become jammed. Even though this bore is therefore smaller than it would have been for a single 18mm or 22mm cutter, ease of cutting is not effected because the preceding smaller-diameter sections have already removed enough material.

**Fig. 2a** shows the cutter having completed an 18mm-diameter hole in 15mm thick steel plate 40. Previously the first section 14 had removed a plug 42 corresponding to the 14mm diameter, as illustrated in **Fig. 2b**. **Fig. 2b** also shows the  $45^\circ$  inclination of the countersink 24 between the 18mm- and 22mm-diameter sections. **Fig. 3** shows the drill being removed.

## CLAIMS

1. A hole-cutting tool comprising an elongate tube  
5 having at one end teeth adapted for cutting  
metal, and fluting extending from between the  
teeth spirally along the tube, in which the  
external diameter of the tool is stepped so as to  
enable to tool to cut more than one diameter of  
hole.  
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2. A hole-cutting tool according to claim 1, in  
which there are steps of three different  
diameters.
- 15 3. A hole-cutting tool according to claim 2, in  
which the diameters are 14, 18 and 22mm.
4. A hole-cutting tool according to any previous  
claim, in which the floor of the fluting is at an  
20 approximately constant radius.
5. A hole-cutting tool according to any previous  
claim, in which the steps have shoulders angled  
at about 45° to the radial plane.  
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6. A hole-cutting tool according to any previous  
claim, in which the bore narrows slightly away  
from the business end.



INVESTOR IN PEOPLE

Application No: GB 0321188.5  
Claims searched: 1 to 6

Examiner: Dominic Green  
Date of search: 8 December 2003

## Patents Act 1977 : Search Report under Section 17

### Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
X	1	EP 0936016 A1	(ULRICH) See esp figs & WPI Abstract Accession No.99-470752/40
X	1	EP 0351493 A2	(DETLEV) See esp figs & WPI Abstract Accession No.90-023952/04
X	1	DE 3905016	(FISCHER) See esp figs & WPI Abstract Accession No.90-261741/35
X	1	FR 725505	(FOUQUET) Esp figs
X	1	JP 11347820	(SEISAKUSHO) See esp figs & WPI Abstract Accession No.00-110458/10
X	1	US 1747117	(KLEIN) Esp figs 1,3,4, & 6

### Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application

### Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC<sup>y</sup>:

B3C

Worldwide search of patent documents classified in the following areas of the IPC<sup>7</sup>:

B23B

The following online and other databases have been used in the preparation of this search report:

Online: WPI, EPODOC, PAJ